



## NATIONAL GUIDELINE CLEARINGHOUSE™ (NGC) GUIDELINE SYNTHESIS

### NUTRITIONAL MANAGEMENT OF DIABETES MELLITUS

#### Guidelines

1. **American Association of Clinical Endocrinologists (AACE).** [American Association of Clinical Endocrinologists medical guidelines for clinical practice for the management of diabetes mellitus. Nutrition and diabetes.](#) Endocr Pract 2007 May-Jun;13(Suppl 1):47-50. [30 references]
2. **American Diabetes Association (Am Diabetes Assoc).** [Nutrition recommendations and interventions for diabetes: a position statement of the American Diabetes Association.](#) Diabetes Care 2008 Jan;31 Suppl 1:S61-78. [119 references]
3. **American Dietetic Association (Am Dietetic Assoc).** [Diabetes type 1 and 2 evidence-based nutrition practice guideline for adults.](#) Chicago (IL): American Dietetic Association; 2008. Various p. [206 references]

#### INTRODUCTION

A direct comparison of the American Association of Clinical Endocrinologists (AACE), American Diabetes Association (Am Diabetes Assoc) and the American Dietetic Association (Am Dietetic Assoc) recommendations for the nutritional management of diabetes mellitus is provided in the following tables. Excluded from this synthesis are recommendations for the nutritional management of gestational diabetes mellitus.

The tables below provide a side-by-side comparison of key attributes of each guideline, including specific interventions and practices that are addressed. The language used in these tables, particularly that which is used in [Table 3](#), [Table 4](#), and [Table 5](#) is in most cases taken verbatim from the original guidelines:

- [Table 1](#) provides a quick-view glance at the primary interventions considered by each group and which make up the focus of this guideline synthesis.
- [Table 2](#) provides a comparison of the overall scope of the included guidelines.
- [Table 3](#) provides a more detailed comparison of the specific recommendations offered by each group for the topics under consideration in this synthesis, including:
  - [General Nutrition Recommendations](#)
  - [Nutritional Interventions for Preventing and Managing Diabetes Complications](#)
  - [Physical Activity and Weight Management](#)
- [Table 4](#) lists the potential benefits and harms associated with the implementation of each guideline as stated in the original guidelines.
- [Table 5](#) presents the rating schemes used by the guideline groups to rate the level of evidence and the strength of the recommendations.

Following the content comparison tables, the [areas of agreement](#) and [differences](#) among the guidelines are identified.

## Abbreviations

- AACE, American Association of Clinical Endocrinologists
- Am Diabetes Assoc, American Diabetes Association
- Am Dietetic Assoc, American Dietetic Association
- CGM, continuous glucose monitoring
- CKD, chronic kidney disease
- CVD, cardiovascular disease
- DRI, daily reference intake
- GFR, glomerular filtration rates
- GDM, gestational diabetes mellitus
- LDL, low-density lipoprotein
- MNT, medical nutrition therapy
- RD, registered dietitian
- SMBG, self-monitoring of blood glucose
- T1DM, type 1 diabetes mellitus
- T2DM, type 2 diabetes mellitus

**TABLE 1: COMPARISON OF INTERVENTIONS AND PRACTICES CONSIDERED**  
(*"✓" indicates topic is addressed*)

	<b>AACE (2007)</b>	<b>Am Diabetes Assoc (2008)</b>	<b>Am Dietetic Assoc (2008)</b>
General Nutrition Recommendations	✓	✓	✓
Nutritional Interventions for Preventing and Managing Diabetes Complications	✓	✓	✓
Physical Activity and Weight Management	✓	✓	✓

**TABLE 2: COMPARISON OF SCOPE AND CONTENT**

<b>Objective and Scope</b>	
<b>AACE (2007)</b>	To provide clinicians with clear and accessible guidelines to care for patients with diabetes mellitus

<b>Am Diabetes Assoc (2008)</b>	<ul style="list-style-type: none"> <li>• To provide evidence-based recommendations and interventions for diabetes MNT</li> <li>• To make people with diabetes and health care providers aware of beneficial nutrition interventions</li> </ul>
<b>Am Dietetic Assoc (2008)</b>	<p><b>Overall Objectives</b></p> <ul style="list-style-type: none"> <li>• To help dietetic practitioners, patients and consumers make shared decisions about health care choices in specific clinical circumstances</li> <li>• To provide evidence-based recommendations for effective MNT in the management of type 1 and type 2 diabetes in adults that assist in the normalization and maintenance of glycemia, lipid profiles, and blood pressure</li> </ul> <p><b>Specific Objectives</b></p> <ul style="list-style-type: none"> <li>• To define evidence-based diabetes nutrition recommendations for RDs that are carried out in collaboration with other health care providers</li> <li>• To guide practice decisions that integrate medical, nutritional, and behavioral strategies</li> <li>• To reduce variations in practice among RDs</li> <li>• To promote self-management strategies that empower the adult with diabetes to take responsibility for day-to-day management</li> <li>• To provide the RD with data to make recommendations to adjust MNT or recommend other therapies to achieve desired outcomes</li> <li>• To enhance the quality of life for the adult with diabetes, utilizing customized strategies based on the individual's preferences, lifestyle, and goals</li> <li>• To develop guidelines for interventions that have measurable clinical outcomes</li> <li>• To define the highest quality of care within cost constraints of the current health care environment</li> </ul>
<b>Target Population</b>	
<b>AACE (2007)</b>	Children, adolescents, and adults with or at risk of developing diabetes mellitus
<b>Am Diabetes Assoc (2008)</b>	<p>Patients at risk of or diagnosed with:</p> <ul style="list-style-type: none"> <li>• Pre-diabetes</li> <li>• Type 1 diabetes</li> <li>• Type 2 diabetes</li> </ul>

	<ul style="list-style-type: none"> <li>• Gestational diabetes mellitus</li> </ul> <p>Sub-populations, include:</p> <ul style="list-style-type: none"> <li>• Youth with type 1 and type 2 diabetes</li> <li>• Pregnant and lactating women</li> <li>• Older adults with diabetes</li> <li>• Individuals treated with insulin or insulin secretagogues</li> <li>• Patients in a variety of settings (public health, acute care facilities, chronic care facilities)</li> </ul>
<b>Am Dietetic Assoc (2008)</b>	Adults (>19 years) with type 1 or type 2 diabetes mellitus
<b>Intended Users</b>	
<b>AACE (2007)</b>	Advanced Practice Nurses Dietitian Nurses Physician Assistants Physicians
<b>Am Diabetes Assoc (2008)</b>	Advanced Practice Nurses Allied Health Personnel Dietitians Nurses Physician Assistants Physicians Public Health Departments
<b>Am Dietetic Assoc (2008)</b>	Advanced Practice Nurses Dietitians Health Care Providers Nurses Pharmacists Physician Assistants Physicians Students

**TABLE 3: COMPARISON OF RECOMMENDATIONS**

**General Nutrition Recommendations**

**AACE  
(2007)**

**Nutrition and Diabetes**

- MNT is an essential component of any comprehensive diabetes mellitus management program (**grade A**).
- Meal composition affects glycemic control and cardiovascular risk (**grade A**).
- Tailor a diet for individual patients based on current weight, medication regimen, food preferences, lifestyle, and lipid profile (**grade A**).
- No specific diet is endorsed by ACE/AACE for people with diabetes mellitus (**grade D**).
- Total dietary carbohydrates should represent 45% to 65% of daily energy intake unless otherwise indicated (**grade D**).
- Protein intake should be the same as for patients who do not have diabetes mellitus: 15% to 20% of daily energy intake (**grade D**).
- Fiber should be consumed in amounts of 25 to 50 g/d or 15 to 25 g/1000 kcal ingested (**grade A**).
- Total dietary fat should generally comprise less than 30% of daily energy intake (**grade D**):
  - Dietary monounsaturated fatty acids and n-3 polyunsaturated fatty acids have beneficial effects on the lipid profile and should comprise most fat intake (**grade B**).
  - Dietary saturated fat should be limited to less than 10% of daily energy intake with less than 300 mg/d of cholesterol (**grade A**).
  - If the patient's LDL-C level is greater than 100 mg/dL, consumption of saturated fat should be limited to less than 7% of daily energy intake, and cholesterol should be limited to less than 200 mg/d (**grade A**).
  - *Trans*-fat intake should be minimized, or preferably, eliminated (**grade D**).
- Basal-bolus insulin therapy using insulin analogs or continuous subcutaneous insulin infusion in conjunction with carbohydrate counting is the most physiologic treatment and provides the greatest flexibility in terms of food choices and timing of meals (**grade B**).
- Basal-bolus therapy using a consistent carbohydrate meal plan can be equally effective for patients unable or unwilling to count carbohydrates (**grade D**).
- Instruct patients who choose to consume alcohol to limit intake to 1 drink per day for women and 2 drinks per day for men (**grade D**).
- Secondary prevention strategies for T2DM in individuals with impaired glucose regulation include a controlled-energy diet, exercise, and weight loss (**grade A**).

**Clinical Considerations**

	<p><u>All Patients With Diabetes Mellitus</u></p> <p>Carbohydrate absorption may be altered by other foods in a mixed meal. For example, fat and fiber delay the absorption of carbohydrates and blunt the glycemic response. Terms such as <i>simple sugars</i> and <i>complex carbohydrates</i> have recently been abandoned since it is now recognized that their effects on blood glucose are similar. Sucrose does not need to be avoided by patients with diabetes mellitus, but when it is consumed, it should replace other carbohydrates in the diet.</p> <p><u>Patients With Type 1 Diabetes Mellitus</u></p> <p>The key to successful MNT is synchronizing carbohydrate intake with insulin therapy. The use of basal-bolus insulin therapy using insulin analogs or continuous subcutaneous insulin infusion in conjunction with carbohydrate counting is the most physiologic treatment and provides the greatest flexibility in terms of food choices and timing of meals. For patients unable or unwilling to count carbohydrates, basal-bolus therapy using a consistent carbohydrate meal plan can be equally effective. Considering the glycemic index and the glycemic load of foods is another tool that can be used to optimally time the mealtime insulin injection.</p> <p><u>Patients With Type 2 Diabetes Mellitus</u></p> <p>Weight control and a controlled-energy diet are essential components of diabetes mellitus management to lower glucose levels and to reduce the risk for cardiovascular disease; cardiovascular risk is lowest when the body mass index is less than 25 kg/m<sup>2</sup>. Physical activity of 30 to 90 minutes per day lowers glucose levels and assists with weight loss or weight maintenance. Salt restriction to less than 1.5 g/d, in association with increased intake of fresh fruits and vegetables, is helpful in managing hypertension. If patients choose to consume alcohol, intake should be limited to 1 drink per day for women and 2 drinks per day for men.</p> <p>Dietary modification to achieve target ranges for glucose, lipids, and blood pressure is a tertiary preventive strategy for the complications of diabetes mellitus.</p>
<p><b>Am Diabetes Assoc (2008)</b></p>	<p><b><u>Major Nutrition Recommendations and Interventions</u></b></p> <p><b>Effectiveness of MNT</b></p> <ul style="list-style-type: none"> <li>• Individuals who have pre-diabetes or diabetes should receive individualized MNT; such therapy is best provided by a RD familiar with the components of diabetes MNT. <b>(B)</b></li> <li>• Nutrition counseling should be sensitive to the personal needs,</li> </ul>

willingness to change, and ability to make changes of the individual with pre-diabetes or diabetes. **(E)**

### **Energy Balance, Overweight, and Obesity**

- For patients on low-carbohydrate diets, monitor lipid profiles, renal function, and protein intake (in those with nephropathy), and adjust hypoglycemic therapy as needed. **(E)**

### **Nutrition Recommendations for the Management of Diabetes (Secondary Prevention)**

#### *Carbohydrate in Diabetes Management*

- A dietary pattern that includes carbohydrate from fruits, vegetables, whole grains, legumes, and low-fat milk is encouraged for good health. **(B)**
- Monitoring carbohydrate, whether by carbohydrate counting, exchanges, or experienced-based estimation, remains a key strategy in achieving glycemic control. **(A)**
- The use of glycemic index and load may provide a modest additional benefit over that observed when total carbohydrate is considered alone. **(B)**
- Sucrose-containing foods can be substituted for other carbohydrates in the meal plan or, if added to the meal plan, covered with insulin or other glucose-lowering medications. Care should be taken to avoid excess energy intake. **(A)**
- As for the general population, people with diabetes are encouraged to consume a variety of fiber-containing foods. However, evidence is lacking to recommend a higher fiber intake for people with diabetes than for the population as a whole. **(B)**
- Sugar alcohols and nonnutritive sweeteners are safe when consumed within the daily intake levels established by the FDA. **(A)**

#### *Dietary Fat and Cholesterol in Diabetes Management*

- Limit saturated fat to <7% of total calories. **(A)**
- Intake of *trans* fat should be minimized. **(E)**
- In individuals with diabetes, limit dietary cholesterol to <200 mg/day. **(E)**
- Two or more servings of fish per week (with the exception of commercially fried fish filets) provide n-3 polyunsaturated fatty acids and are recommended. **(B)**

#### *Protein in Diabetes Management*

- For individuals with diabetes and normal renal function, there is insufficient evidence to suggest that usual protein intake (15%

to 20% of energy) should be modified. **(E)**

- In individuals with type 2 diabetes, ingested protein can increase insulin response without increasing plasma glucose concentrations. Therefore, protein should not be used to treat acute or prevent nighttime hypoglycemia. **(A)**
- High-protein diets are not recommended as a method for weight loss at this time. The long-term effects of protein intake >20% of calories on diabetes management and its complications are unknown. Although such diets may produce short-term weight loss and improved glycemia, it has not been established that these benefits are maintained long term, and long-term effects on kidney function for persons with diabetes are unknown. **(E)**

#### *Alcohol in Diabetes Management*

- If adults with diabetes choose to use alcohol, daily intake should be limited to a moderate amount (one drink per day or less for women and two drinks per day or less for men). **(E)**
- To reduce risk of nocturnal hypoglycemia in individuals using insulin or insulin secretagogues, alcohol should be consumed with food. **(E)**
- In individuals with diabetes, moderate alcohol consumption (when ingested alone) has no acute effect on glucose and insulin concentrations but carbohydrate co-ingested with alcohol (as in a mixed drink) may raise blood glucose. **(B)**

#### *Micronutrients in Diabetes Management*

- There is no clear evidence of benefit from vitamin or mineral supplementation in people with diabetes (compared with the general population) who do not have underlying deficiencies. **(A)**
- Routine supplementation with antioxidants, such as vitamins E and C and carotene, is not advised because of lack of evidence of efficacy and concern related to long-term safety. **(A)**
- Benefit from chromium supplementation in individuals with diabetes or obesity has not been clearly demonstrated and therefore cannot be recommended. **(E)**

### **Nutrition Interventions for Specific Populations**

#### *Nutrition Interventions for Type 1 Diabetes*

- For individuals with type 1 diabetes, insulin therapy should be integrated into an individual's dietary and physical activity pattern. **(E)**
- Individuals using rapid-acting insulin by injection or an insulin pump should adjust the meal and snack insulin doses based on the carbohydrate content of the meals and snacks. **(A)**



	<ul style="list-style-type: none"> <li>• For individuals using fixed daily insulin doses, carbohydrate intake on a day-to-day basis should be kept consistent with respect to time and amount. <b>(C)</b></li> <li>• For planned exercise, insulin doses can be adjusted. For unplanned exercise, extra carbohydrate may be needed. <b>(E)</b></li> </ul> <p><i>Nutrition Interventions for Type 2 Diabetes</i></p> <ul style="list-style-type: none"> <li>• Individuals with type 2 diabetes are encouraged to implement lifestyle modifications that reduce intakes of energy, saturated and <i>trans</i> fatty acids, cholesterol, and sodium and to increase physical activity in an effort to improve glycemia, dyslipidemia, and blood pressure. <b>(E)</b></li> <li>• Plasma glucose monitoring can be used to determine whether adjustments in foods and meals will be sufficient to achieve blood glucose goals or if medication(s) needs to be combined with MNT. <b>(E)</b></li> </ul> <p><i>Nutrition Interventions for Older Adults with Diabetes</i></p> <ul style="list-style-type: none"> <li>• Obese older adults with diabetes may benefit from modest energy restriction and an increase in physical activity; energy requirement may be less than for a younger individual of a similar weight. <b>(E)</b></li> <li>• A daily multivitamin supplement may be appropriate, especially for those older adults with reduced energy intake. <b>(C)</b></li> </ul>
<p><b>Am Dietetic Assoc (2008)</b></p>	<p><b><u>DM: MNT</u></b></p> <p><b>MNT and Number/Length of Initial Series of Encounters</b></p> <p>MNT provided by a RD is recommended for individuals with type 1 and type 2 diabetes. An initial series of three to four encounters each lasting from 45 to 90 minutes is recommended. This series, beginning at diagnosis of diabetes or at first referral to an RD for MNT for diabetes, should be completed within three to six months. The RD should determine if additional MNT encounters are needed after the initial series based on the nutrition assessment of learning needs and progress towards desired outcomes.</p> <p><b>Strong, Imperative</b></p> <p><b>MNT Long-Term Follow-up Encounters</b></p> <p>At least one follow-up encounter is recommended annually to reinforce lifestyle changes and to evaluate and monitor outcomes that impact the need for changes in MNT or medication. The RD should determine if additional MNT encounters are needed.</p>

**Strong, Imperative**

**Recommendations Strength Rationale**

- **Conclusion statement was Grade I.**

**DM: Assessment and Diabetes**

**Nutrition Assessment**

The RD should assess food intake (focusing on carbohydrate), medication, metabolic control (glycemia, lipids, and blood pressure), anthropometric measurements and physical activity to serve as the basis for implementation of the nutrition prescription, goals and intervention. Individuals who have diabetes should receive MNT tailored by the RD.

**Strong, Imperative**

**Recommendations Strength Rationale**

- **Conclusion statement was Grade I**

**DM: Assessment of Glycemic Control**

**Assessment of Glycemic Control**

The RD should assess glycemic control and focus MNT to achieve and maintain blood glucose levels in the target range (target glucose levels noted in the American Diabetes Association Standards of Medical Care in Diabetes).

**Strong, Imperative**

**Recommendation Strength Rationale**

- **Conclusion statement was Grade I.**

**DM: Assess Relative Importance of Weight Management**

**Assess Relative Importance of Weight Management**

The RD should assess the relative importance of weight management for persons with diabetes who are overweight or obese. While modest weight loss has been shown to improve insulin resistance in overweight and obese insulin-resistant individuals, research on sustained weight loss interventions lasting 1 year or longer reported inconsistent effects on A1C.

**Strong, Conditional**

**Recommendation Strength Rationale**

- **Conclusion statement was Grade II.**

**DM: Intervention Options**

**Intervention Options**

The RD should implement MNT selecting from a variety of interventions (reduced energy and fat intake, carbohydrate counting, simplified meal plans, healthy food choices, individualized meal planning strategies, exchange lists, insulin-to-carbohydrate ratios, physical activity and behavioral strategies). Nutrition education and counseling should be sensitive to the personal needs, willingness to change, and ability to make changes of the individual with diabetes.

**Strong, Imperative**

**Recommendation Strength Rationale**

- **Conclusion statement was Grade I**

**DM: Macronutrients**

**Macronutrient Percentages**

The RD should encourage consumption of macronutrients based on the Dietary Reference Intakes (DRI) for healthy adults. Research does not support any ideal percentage of energy from macronutrients for persons with diabetes.

**Strong, Imperative**

**Recommendation Strength Rationale**

- **Conclusion statement for Carbohydrate was Grade I**
- **Conclusion statement for Protein was Grade II**

**DM: Carbohydrate**

**Carbohydrate Intake Consistency**

In persons on either MNT alone, glucose-lowering medications or fixed insulin doses, meal and snack carbohydrate intake should be kept consistent on a day-to-day basis. Consistency in carbohydrate

intake results in improved glycemic control.

**Strong**, Conditional

### **Carbohydrate Intake and Insulin Dose Adjustment**

In persons with type 1 or type 2 diabetes who adjust their mealtime insulin doses or who are on insulin pump therapy, insulin doses should be adjusted to match carbohydrate intake (insulin-to-carbohydrate ratio). This can be accomplished by comprehensive nutrition education and counseling on interpretation of blood glucose patterns, nutrition-related medication management and collaboration with the healthcare team. Adjusting insulin dose based on planned carbohydrate intake improves glycemic control and quality of life without any adverse effects.

**Strong**, Conditional

### **Recommendation Strength Rationale**

- **Conclusion statement was Grade I**

### **DM: Sucrose and Diabetes**

#### **Sucrose Intake**

If persons with diabetes choose to eat foods containing sucrose, the sucrose-containing foods should be substituted for other carbohydrate foods. Sucrose intakes of 10 to 35 percent of total energy intake do not have a negative effect on glycemic or lipid responses when substituted for isocaloric amounts of starch.

**Strong**, Conditional

### **Recommendation Strength Rationale**

- **Conclusion statement was Grade I**

### **DM: Non-nutritive Sweeteners and Diabetes**

#### **Non-nutritive Sweeteners**

If persons with diabetes choose to consume products containing U.S. FDA-approved non-nutritive sweeteners, at levels that do not exceed the acceptable daily intakes (ADIs), the RD should advise that some of these products may contain energy and carbohydrate from other sources that needs to be accounted for. Research on non-nutritive sweeteners reports no effect on changes in glycemic

response.

**Fair**, Conditional

**Recommendation Strength Rationale**

- **Conclusion statements were Grade III**

**DM: Glycemic Index and Diabetes**

**Glycemic Index**

If the use of glycemic index (GI) is proposed as a method of meal planning, the RD should advise on the conflicting evidence of effectiveness of this strategy. Studies comparing high versus low GI diets report mixed effects on A1C.

**Fair**, Conditional

**Recommendation Strength Rationale**

- **Conclusion statement was Grade II**

**DM: Fiber and Diabetes**

**Fiber Intake and Glycemia**

Recommendations for fiber intake for people with diabetes are similar to the recommendations for the general public (DRI: 14 grams per 1000 kcal). While diets containing 44 to 50 grams of fiber daily are reported to improve glycemia; more usual fiber intakes (up to 24 grams daily) have not shown beneficial effects on glycemia. It is unknown if free-living individuals can daily consume the amount of fiber needed to improve glycemia.

**Strong**, Imperative

**Fiber Intake and Cholesterol**

Include foods containing 25 to 30 grams of fiber per day, with special emphasis on soluble fiber sources (7 to 13 grams). Diets high in total and soluble fiber, as part of cardioprotective nutrition therapy, can further reduce total cholesterol by 2% to 3% and LDL cholesterol up to 7%.

**Strong**, Imperative

**Recommendation Strength Rationale**

- **Conclusion statement for Fiber and Diabetes was Grade I**
- **Conclusion statement for Fiber and Coronary Heart Disease (CHD) were Grades I, II, and III**

### **DM: Protein and Diabetes**

#### **Protein Intake and Normal Renal Function**

In persons with type 1 or type 2 diabetes with normal renal function, the RD should advise that usual protein intake of approximately 15% to 20% of daily energy intake does not need to be changed. Although protein has an acute effect on insulin secretion, usual protein intake in long-term studies has minimal effects on glucose, lipids, and insulin concentrations.

**Fair**, Conditional

#### **Recommendation Strength Rationale**

- **Conclusion statements were Grade II.**

### **DM: Glucose Monitoring**

#### **Blood Glucose Monitoring**

For individuals on nutrition therapy alone or nutrition therapy in combination with glucose-lowering medications, SMBG is recommended. Frequency and timing is dependent on diabetes management goals and therapies (i.e., MNT, diabetes medications and physical activity). When SMBG is incorporated into diabetes education programs and the information from SMBG is used to make changes in diabetes management, SMBG is associated with improved glycemic control.

**Fair**, Conditional

#### **Frequency of Blood Glucose Monitoring**

For persons with type 1 or type 2 diabetes on insulin therapy, at least three to eight blood glucose tests per day are recommended to determine the adequacy of the insulin dose(s) and guide adjustments in insulin dose(s), food intake and physical activity. Some insulin regimens require more testing to establish the best integrated therapy (insulin, food, and activity). Once established, some insulin regimens will require less frequent SMBG. Intervention studies that include self-management training and adjustment of insulin doses based on SMBG result in improved glycemic control.

**Strong, Conditional**

**Possible Need for Continuous Glucose Monitoring or More Frequent SMBG**

Persons experiencing unexplained elevations in A1C or unexplained hypoglycemia and hyperglycemia may benefit from use of CGM or more frequent SMBG. It is essential that persons with diabetes receive education as to how to calibrate CGM and how to interpret CGM results. Studies have proven the accuracy of CGM and most show that using the trend/pattern data from CGM can result in less glucose variability and improved glucose control.

**Fair, Conditional**

**Recommendation Strength Rationale**

- **Conclusion statements were Grades I and II**

**DM: Coordination of Care and Diabetes**

**Coordination of Care**

The RD should implement MNT and coordinate care with an interdisciplinary team. An interdisciplinary team approach is necessary to integrate MNT for patients with diabetes into overall management.

**Consensus, Imperative**

**Recommendation Strength Rationale**

- **Conclusion statement was Grade I**

**DM: Monitor & Evaluate and Diabetes**

**Monitoring and Evaluation**

The RD should monitor and evaluate food intake, medication, metabolic control (glycemia, lipids, and blood pressure), anthropometric measurements and physical activity. Research reports sustained improvements in A1C at 12 months and longer with long-term follow-up encounters with an RD.

**Strong, Imperative**

**Evaluation of Glycemic Control**

The RD should primarily use blood glucose monitoring results in

	<p>evaluating the achievement of goals and effectiveness of MNT. Glucose monitoring results can be used to determine whether adjustments in foods and meals will be sufficient to achieve blood glucose goals or if medication additions or adjustments need to be combined with MNT.</p> <p><b>Consensus</b>, Imperative</p> <p><b>Recommendation Strength Rationale</b></p> <ul style="list-style-type: none"> <li>• <b>Conclusion statement for MNT was Grade I</b></li> </ul>
<p align="center"><b>Nutritional Interventions for Preventing and Managing Diabetes Complications</b></p>	
<p><b>AACE (2007)</b></p>	<p><b>Nutrition and Diabetes</b></p> <ul style="list-style-type: none"> <li>• Dietary modification to achieve target ranges for glucose, lipids, and blood pressure is a tertiary preventive strategy for the complications of diabetes mellitus (<b>grade A</b>).</li> <li>• Restrict the following in patients with CKD: sodium, 1.5 to 2.4 g/d; phosphate, 800 to 1000 mg/d (stages 3 to 5); potassium, 2 to 3 g/d (stage 5 on hemodialysis) and 3 to 4 g/d (stage 5 on peritoneal dialysis); and protein, 0.8 g/d (stages 1 to 2), 0.6 g/d (stages 3 to 4), 1.2 g/d (stage 5 on hemodialysis), and 1.3 g/d (stage 5 on peritoneal dialysis) (<b>grade A</b>).</li> <li>• For optimal nitrogen retention, prescribe 1 daily multivitamin and a diet with adequate protein for patients with diabetes mellitus who have nonhealing wounds; consider additional micronutrients such as zinc and oral vitamins C and A depending on the severity of the wounds and the nutritional status of the patient (<b>grade D</b>).</li> </ul> <p><u>Special Populations</u></p> <p>Patients with CKD require special attention to diet, including restrictions of sodium, phosphate (renal failure stages 3-5), potassium, and protein. Patients with diabetes mellitus who have nonhealing wounds should take 1 daily multivitamin and adequate protein for optimal nitrogen retention; additional micronutrients, such as zinc and oral vitamins C and A, can be considered depending on the severity of the wounds and the nutritional status of the patient.</p>
<p><b>Am Diabetes Assoc (2008)</b></p>	<p><b>Treating and Controlling Diabetes Complications (Tertiary Prevention)</b></p> <p><i>Microvascular Complications</i></p>



	<ul style="list-style-type: none"> <li>• Reduction of protein intake to 0.8 to 1.0 g/kg body wt/day in individuals with diabetes and the earlier stages of CKD and to 0.8 g/kg body wt/day in the later stages of CKD may improve measures of renal function (urine albumin excretion rate, glomerular filtration rate) and is recommended. <b>(B)</b></li> <li>• MNT that favorably affects cardiovascular risk factors may also have a favorable effect on microvascular complications such as retinopathy and nephropathy. <b>(C)</b></li> </ul> <p><i>Treatment and Management of CVD Risk</i></p> <ul style="list-style-type: none"> <li>• Target A1C is as close to normal as possible without significant hypoglycemia. <b>(B)</b></li> <li>• For patients with diabetes at risk for cardiovascular disease, diets high in fruits, vegetables, whole grains, and nuts may reduce the risk. <b>(C)</b></li> <li>• For patients with diabetes and symptomatic heart failure, dietary sodium intake of &lt;2,000 mg/day may reduce symptoms. <b>(C)</b></li> <li>• In normotensive and hypertensive individuals, a reduced sodium intake (e.g., 2,300 mg/day) with a diet high in fruits, vegetables, and low-fat dairy products lowers blood pressure. <b>(A)</b></li> <li>• In most individuals, a modest amount of weight loss beneficially affects blood pressure. <b>(C)</b></li> </ul>
<p><b>Am Dietetic Assoc (2008)</b></p>	<p><b><u>DM: Prevention and Treatment of CVD</u></b></p> <p><b>CVD and Cardioprotective Nutrition Therapy</b></p> <p>Cardioprotective nutrition interventions for the prevention and treatment of CVD should be implemented in the initial series of encounters. Diabetes is associated with an increased risk for CVD and glycemic control may improve the lipid profile.</p> <p><b>Strong, Imperative</b></p> <p><b>CVD and Cardioprotective Nutrition Interventions</b></p> <p>Cardioprotective nutrition interventions for prevention and treatment of CVD include reduction in saturated and trans fats and dietary cholesterol, and interventions to improve blood pressure. Studies in persons with diabetes utilizing these interventions report a reduction in cardiovascular risk and improved cardiovascular outcomes.</p> <p><b>Strong, Imperative</b></p>

	<p><b>Recommendation Strength Rationale</b></p> <p><b>Conclusion statement was Grade I</b></p> <p><b><u>DM: Protein and Diabetes</u></b></p> <p><b>Protein Intake and Nephropathy</b></p> <p>In persons with diabetic nephropathy, a protein intake of one gram or less per kg body weight per day is recommended. Diets with less than one gram protein per kg body weight per day have been shown to improve albuminuria in persons with nephropathy; however, they have not been shown to have significant effects on GFR.</p> <p><b>Fair, Conditional</b></p> <p><b>Protein Intake and Late Stage Nephropathy</b></p> <p>For persons with late stage diabetic nephropathy (CKD Stages 3-5), hypoalbuminemia (an indicator of malnutrition) and energy intake must be monitored and changes in protein and energy intake made to correct deficits. A protein intake of approximately 0.7 grams per kg body weight per day has been associated with hypoalbuminemia, whereas a protein intake of approximately 0.9 grams per kg body weight per day has not.</p> <p><b>Fair, Conditional</b></p> <p><b>Recommendation Strength Rationale</b></p> <ul style="list-style-type: none"> <li>Conclusion statement is Grade II</li> </ul>
<b>Physical Activity and Weight Management</b>	
<b>AACE (2007)</b>	<p><b><u>Patients With Type 2 Diabetes Mellitus</u></b></p> <p>Weight control and a controlled-energy diet are essential components of diabetes mellitus management to lower glucose levels and to reduce the risk for cardiovascular disease; cardiovascular risk is lowest when the body mass index is less than 25 kg/m<sup>2</sup>. Physical activity of 30 to 90 minutes per day lowers glucose levels and assists with weight loss or weight maintenance.</p>
<b>Am Diabetes Assoc (2008)</b>	<p><b>Energy Balance, Overweight, and Obesity</b></p> <ul style="list-style-type: none"> <li>In overweight and obese insulin-resistant individuals, modest weight loss has been shown to improve insulin resistance. Thus,</li> </ul>

	<p>weight loss is recommended for all such individuals who have or are at risk for diabetes. <b>(A)</b></p> <ul style="list-style-type: none"> <li>• For weight loss, either low-carbohydrate or low-fat calorie-restricted diets may be effective in the short term (up to 1 year). <b>(A)</b></li> <li>• Physical activity and behavior modification are important components of weight loss programs and are most helpful in maintenance of weight loss. <b>(B)</b></li> <li>• Weight loss medications may be considered in the treatment of overweight and obese individuals with <b>type 2 diabetes</b> and can help achieve a 5% to 10% weight loss when combined with lifestyle modification. <b>(B)</b></li> <li>• Bariatric surgery may be considered for some individuals with <b>type 2 diabetes</b> and body mass index (BMI) <math>\geq 35</math> kg/m<sup>2</sup> and can result in marked improvements in glycemia. The long-term benefits and risks of bariatric surgery in individuals with pre-diabetes or diabetes continue to be studied. <b>(B)</b></li> </ul> <p><i>Nutrition Interventions for Type 1 Diabetes</i></p> <ul style="list-style-type: none"> <li>• For individuals with type 1 diabetes, insulin therapy should be integrated into an individual's dietary and physical activity pattern. <b>(E)</b></li> <li>• For planned exercise, insulin doses can be adjusted. For unplanned exercise, extra carbohydrate may be needed. <b>(E)</b></li> </ul>
<p><b>Am Dietetic Assoc (2008)</b></p>	<p><b><u>DM: Weight Management</u></b></p> <p><b>Diabetes and Weight Management</b></p> <p>The RD should advise that glycemic control is the primary focus for diabetes management. While decreasing energy intake may improve glycemic control, it is unclear whether weight loss alone will improve glycemic control. Sustained weight loss interventions lasting 1 year or longer reported inconsistent effects on hemoglobin A1C.</p> <p><b>Fair, Conditional</b></p> <p><b>Recommendation Strength Rationale</b></p> <ul style="list-style-type: none"> <li>• <b>Conclusion statement was Grade II</b></li> </ul> <p><b><u>DM: Physical Activity</u></b></p> <p><b>Type 2 Diabetes and Physical Activity</b></p> <p>In persons with type 2 diabetes, 90 to 150 minutes of accumulated moderate-intensity aerobic physical activity per week as well as</p>

	<p>resistance/strength training three times per week is recommended. Both aerobic and resistance training improve glycemic control, independent of weight loss. Physical activity also improves insulin sensitivity and decreases risk for cardiovascular disease and all-cause mortality.</p> <p><b>Strong</b>, Conditional</p> <p><b>Type 1 Diabetes and Physical Activity</b></p> <p>Individuals with type 1 diabetes should be encouraged to engage in regular physical activity. Although exercise is not reported to improve glycemic control in persons with type 1 diabetes, individuals may receive the same benefits from exercise as the general public—decreased risk for cardiovascular disease and improved sense of well-being.</p> <p><b>Fair</b>, Conditional</p> <p><b>Physical Activity and Insulin/Insulin Secretagogue Use</b></p> <p>The RD should instruct individuals on insulin or insulin secretagogues on the safety guidelines to prevent hypoglycemia (frequent blood glucose monitoring and possible adjustment in insulin dose or carbohydrate intake). Research indicates that the incidence of hypoglycemia during exercise may depend on baseline glucose levels.</p> <p><b>Fair</b>, Conditional</p> <p><b>Recommendation Strength Rationale</b></p> <ul style="list-style-type: none"> <li>• <b>Conclusion statements were Grades I and II</b></li> </ul>
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<b>TABLE 4: BENEFITS AND HARMS</b>	
<b>Benefits</b>	
<b>AACE (2007)</b>	Intensive treatment of diabetes mellitus and conditions known to be risk factors can significantly decrease the development and/or progression of chronic complications.
<b>Am Diabetes Assoc</b>	<ul style="list-style-type: none"> <li>• Decreased risk of diabetes and cardiovascular disease through promoting healthy food choices and physical activity leading to moderate weight loss</li> </ul>

<b>(2008)</b>	<ul style="list-style-type: none"> <li>• Normalization of blood glucose levels, lipid and lipoprotein profiles, and blood pressure</li> <li>• Modification of nutrient intake and lifestyle to prevent, or at least slow, the rate of development of the chronic complications of diabetes</li> </ul>
<b>Am Dietetic Assoc (2008)</b>	<ul style="list-style-type: none"> <li>• A primary goal of implementing these recommendations includes improving an adult's ability to achieve optimal nutrition through healthful food choices and a physically active lifestyle. MNT employing either a series of individual or group sessions and employing a variety of nutrition interventions also report improvements in glycemia, lipid profiles and blood pressure, improved weight management, decreased need for medications, and reduction in the risk for onset and progression of comorbidities.</li> <li>• Although costs of MNT sessions and reimbursement vary, medical nutrition therapy sessions are essential for improved outcomes. MNT education can be considered cost effective when considering the benefits of nutrition interventions on the onset and progression of comorbidities versus the cost of the intervention. Furthermore, MNT can be considered cost effective as interventions for prevention or delay of type 2 diabetes saves the cost of the intervention.</li> </ul>
<b>Harms</b>	
<b>AACE (2007)</b>	Not stated
<b>Am Diabetes Assoc (2008)</b>	Exercise can pose potential risks such as cardiac ischemia, musculoskeletal injuries, and hypoglycemia in patients treated with insulin or insulin secretagogues.
<b>Am Dietetic Assoc (2008)</b>	<p><b>Overall Risk/Harm Considerations</b></p> <p>When using these recommendations:</p> <ul style="list-style-type: none"> <li>• Review the patient's age, socioeconomic status, cultural issues, and other health conditions.</li> <li>• Consider a referral to a behavioral specialist if psychosocial issues are a concern.</li> <li>• Consider a referral to social services to assist patients with financial arrangements if economic issues are a concern.</li> <li>• Use clinical judgment when evaluating patients with long-standing diabetes and comorbid conditions.</li> </ul>

## **Recommendation Specific Risks/Harms**

### **Macronutrients**

#### *Carbohydrate*

- Although total carbohydrate content of meals and snacks is the first priority, macronutrient content and total energy intake cannot be ignored as excessive energy intake may lead to weight gain, even if glycemic control is maintained.
- Diets too low in carbohydrates eliminate many foods that are important sources of vitamins, minerals, fiber, and energy.

#### *Sucrose*

- Excessive substitution of sucrose for starches could potentially contribute to inadequate intake of foods contributing other essential nutrients. If sucrose-containing foods are habitually added to usual intake, excessive energy intake is a concern.

#### *Protein*

- Diets too low in protein and energy intake can lead to hypoalbuminemia (malnutrition) and unintentional weight loss. This needs to be monitored in persons with diabetic neuropathy who are restricting protein intake and may have a diminished appetite.

### **Self-Monitoring of Blood Glucose**

- Frequent glucose self-monitoring may cause pain and discomfort.
- Individuals should know of proper disposal of hazardous waste.

### **Physical Activity**

- Before beginning a program of physical activity more vigorous than brisk walking, people with diabetes should be assessed for conditions that might be associated with an increased risk of cardiovascular disease. Of concern are uncontrolled hypertension, severe autonomic or peripheral neuropathy, and preproliferative or proliferative retinopathy or macular edema.
- In previously sedentary individuals whose 10-year risk of a coronary event is likely to be equal to or greater than 10%, a graded exercise test with electrocardiogram monitoring is recommended.
- In individuals taking insulin or insulin secretagogues, physical activity can cause hypoglycemia if medication dose or carbohydrate intake is not adjusted. Carbohydrate should be

	ingested if pre-exercise levels are less than 100 mg/dL.
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TABLE 5: EVIDENCE RATING SCHEMES AND REFERENCES			
AACE (2007)	Levels of Substantiation in Evidence-Based Medicine <sup>a</sup>		
	Level-of-Evidence Category <sup>b</sup>	Study Design or Information Type	Comments
	1	Randomized controlled trials  Multicenter trials  Large meta-analyses with quality ratings	Well-conducted, well-controlled centers  Data derived from a substantial number of studies with high power; substantial number of studies  Consistent pattern of findings in which a recommendation is made - generally  Compelling nonexperimental, clinical data, such as use of insulin in diabetic ketoacidosis
	2	Randomized controlled trials  Prospective cohort studies  Meta-analyses of cohort studies  Case-control studies	Limited number of trials, small sample size  Well-conducted studies  Inconsistent findings or results in the target population
	3	Methodologically flawed randomized controlled trials  Nonrandomized controlled trials  Observational studies  Case series or case reports	Trials with 1 or more major or minor flaws  Uncontrolled or poorly controlled studies  Retrospective or observational studies  Conflicting data with weight of evidence insufficient for final recommendation
	4	Expert consensus	Inadequate data for inclusion in levels 1, 2, or 3; data necessitates an expert opinion

	<div>Expert opinion based on experience</div> <div>Theory-driven conclusions</div> <div>Unproven claims</div> <div>Experience-based information</div>	literature and a consensus										
<div><sup>a</sup>Adapted from the American Association of Clinical Endocrinologists Protocol for the Standard of Care Practice Guidelines.</div> <div><sup>b</sup>Level-of-evidence categories 1 through 3 indicate scientific substantiation or proof; level 4 indicates unproven claims.</div>												
<div>Recommendation Grades in Evidence-Based Medicine<sup>a</sup></div> <table><tr><th>Grade</th><th>Description</th></tr><tr><td>A</td><td><div>Homogeneous evidence from multiple well-designed randomized controlled trials with adequate power</div><div>Homogeneous evidence from multiple well-designed cohort controlled trials with adequate power</div><div>≥1 conclusive level of evidence category 1 publications demonstrating benefit &gt;&gt; risk</div></td></tr><tr><td>B</td><td><div>Evidence from at least one large well-designed clinical trial, cohort or case-control study, or meta-analysis</div><div>No conclusive level of evidence category 1 publication; ≥1 conclusive level of evidence category 2 publications demonstrating benefit &gt;&gt; risk</div></td></tr><tr><td>C</td><td><div>Evidence based on clinical experience, descriptive studies, or expert consensus</div><div>No conclusive level 1 or 2 publication; ≥1 conclusive level of evidence category 3 publication demonstrating benefit &gt;&gt; risk</div><div>No conclusive risk at all and no conclusive benefit demonstrated by evidence</div></td></tr><tr><td>D</td><td><div>Not rated</div><div>No conclusive level of evidence category 1, 2, or 3 publication demonstrating benefit &gt;&gt; risk</div><div>Conclusive level of evidence category 1, 2, or 3 publication demonstrating benefit &gt;&gt; risk</div></td></tr></table>			Grade	Description	A	<div>Homogeneous evidence from multiple well-designed randomized controlled trials with adequate power</div> <div>Homogeneous evidence from multiple well-designed cohort controlled trials with adequate power</div> <div>≥1 conclusive level of evidence category 1 publications demonstrating benefit &gt;&gt; risk</div>	B	<div>Evidence from at least one large well-designed clinical trial, cohort or case-control study, or meta-analysis</div> <div>No conclusive level of evidence category 1 publication; ≥1 conclusive level of evidence category 2 publications demonstrating benefit &gt;&gt; risk</div>	C	<div>Evidence based on clinical experience, descriptive studies, or expert consensus</div> <div>No conclusive level 1 or 2 publication; ≥1 conclusive level of evidence category 3 publication demonstrating benefit &gt;&gt; risk</div> <div>No conclusive risk at all and no conclusive benefit demonstrated by evidence</div>	D	<div>Not rated</div> <div>No conclusive level of evidence category 1, 2, or 3 publication demonstrating benefit &gt;&gt; risk</div> <div>Conclusive level of evidence category 1, 2, or 3 publication demonstrating benefit &gt;&gt; risk</div>
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B	<div>Evidence from at least one large well-designed clinical trial, cohort or case-control study, or meta-analysis</div> <div>No conclusive level of evidence category 1 publication; ≥1 conclusive level of evidence category 2 publications demonstrating benefit &gt;&gt; risk</div>											
C	<div>Evidence based on clinical experience, descriptive studies, or expert consensus</div> <div>No conclusive level 1 or 2 publication; ≥1 conclusive level of evidence category 3 publication demonstrating benefit &gt;&gt; risk</div> <div>No conclusive risk at all and no conclusive benefit demonstrated by evidence</div>											
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	<p><sup>a</sup>Adapted from the American Association of Clinical Endocrinologists Protocol for the Standard of Care Practice Guidelines.</p>
<p><b>Am Diabetes Assoc (2008)</b></p>	<p><b>American Diabetes Association's Evidence Grading System for Clinical Practice</b></p> <p><b>A</b></p> <p>Clear evidence from well-conducted, generalizable, randomized controlled trials that are</p> <ul style="list-style-type: none"> <li>• Evidence from a well-conducted multicenter trial</li> <li>• Evidence from a meta-analysis that incorporated quality ratings in the analysis</li> <li>• Compelling non-experimental evidence (i.e., "all or none" rule developed by the Center for Evidence-Based Medicine at Oxford*)</li> </ul> <p>Supportive evidence from well-conducted randomized, controlled trials that are adequate</p> <ul style="list-style-type: none"> <li>• Evidence from a well-conducted trial at one or more institutions</li> <li>• Evidence from a meta-analysis that incorporated quality ratings in the analysis</li> </ul> <p><i>*Either all patients died before therapy and at least some survived with therapy, or some died with therapy and none died with therapy. Example: use of insulin in the treatment of diabetic ketoacidosis</i></p> <p><b>B</b></p> <p>Supportive evidence from well-conducted cohort studies, including:</p> <ul style="list-style-type: none"> <li>• Evidence from a well-conducted prospective cohort study or registry</li> <li>• Evidence from a well-conducted meta-analysis of cohort studies</li> </ul> <p>Supportive evidence from a well-conducted case-control study</p> <p><b>C</b></p> <p>Supportive evidence from poorly controlled or uncontrolled studies, including:</p> <ul style="list-style-type: none"> <li>• Evidence from randomized clinical trials with one or more major or three or more minor limitations that could invalidate the results</li> <li>• Evidence from observational studies with high potential for bias (such as case series without controls)</li> <li>• Evidence from case series or case reports</li> </ul> <p>Conflicting evidence with the weight of evidence supporting the recommendation</p> <p><b>D</b></p> <p>Conflicting evidence with the weight of evidence supporting the recommendation</p> <p><b>E</b></p> <p>Expert consensus or clinical experience</p>

Am Dietetic Assoc (2008)	<b>Conditional versus Imperative Recommendations</b>				
	<p>Recommendations can be worded as <b>conditional</b> or <b>imperative</b> statements. Conditional statements are specific to a specific situation, while imperative statements are broadly applicable to the target population and its pertinence. More specifically, a conditional recommendation can be stated in if/then terms (e.g., "If a person does not eat food sources of omega-3 fatty acids, then 1g of EPA and DHA omega-3 fatty acids are recommended for secondary prevention").</p> <p>In contrast, imperative recommendations "require," or "must," or "should achieve certain outcomes" (e.g., "Portion control is required as part of a comprehensive weight management program. Portion control at meals and snacks is required to achieve weight intake and weight loss").</p>				
	<b>Levels of Evidence</b>				
	<b>Strength of Evidence Elements</b>	<b>Grade I Good/Strong</b>	<b>Grade II Fair</b>	<b>Grade III Limited/Weak</b>	<b>Grade IV Very Limited</b>
	<b>Quality</b> <ul style="list-style-type: none"><li>Scientific rigor/validity</li><li>Considers design and execution</li></ul>	Studies of strong design for question  Free from design flaws, bias and execution problems	Studies of strong design for question with minor methodological concerns  OR  Only studies of weaker study design for question	Studies of weak design for answering the question  OR  Inconclusive findings due to design flaws, bias or execution problems	Studies of very weak design for answering the question  OR  Findings based on case reports or expert opinion
	<b>Consistency</b>  Of findings across studies	Findings generally consistent in direction and size of effect or degree of association, and statistical significance with minor exceptions at most	Inconsistency among results of studies with strong design  OR  Consistency with minor exceptions across studies of weaker designs	Unexplained inconsistency among results from different studies  OR  Single study unconfirmed by other studies	Unexplained inconsistency among results from different studies  OR  Single study unconfirmed by other studies

	<b>Quantity</b> <ul style="list-style-type: none"> <li>Number of studies</li> <li>Number of subjects in studies</li> </ul>	<p>One to several good quality studies</p> <p>Large number of subjects studies</p> <p>Studies with negative results having sufficiently large sample size for adequate statistical power</p>	<p>Several studies by independent investigators</p> <p>Doubts about adequacy of sample size to avoid Type I and Type II error</p>	<p>Limited number of studies</p> <p>Low number of subjects studies and/or inadequate sample size within studies</p>	
	<b>Clinical Impact</b> <ul style="list-style-type: none"> <li>Importance of studies outcomes</li> <li>Magnitude of effect</li> </ul>	<p>Studied outcome relates directly to the question</p> <p>Size of effect is clinically meaningful</p> <p>Significant (statistical) difference is large</p>	<p>Some doubt about the statistical or clinical significance of effect</p>	<p>Studies outcome is an intermediate outcome or surrogate for the true outcome of interest</p> <p>OR</p> <p>Size of effect is small or lacks statistical and/or clinical significance</p>	
	<b>Generalizability</b> <p>To population of interest</p>	<p>Studied population, intervention and outcomes are free from serious doubts about generalizability</p>	<p>Minor doubts about generalizability</p>	<p>Serious doubts about generalizability due to narrow or different study population, intervention or outcomes studied</p>	
	<p>The levels of evidence was based on the grading system from: <i>Greer N, Mosser G, Log practical approach to evidence grading. Jt Comm. J Qual Improv. 2000; 26:700-712. I</i></p>				

Research Committee modified the grading system to this current version.

### Criteria for Recommendation Rating

Statement Rating	Definition	Implications
<b>Strong</b>	A <b>Strong</b> recommendation means that the workgroup believes that the benefits of the recommended approach clearly exceed the harms (or that the harms clearly exceed the benefits in the case of a strong negative recommendation), and that the quality of the supporting evidence is excellent/good (grade I or II)*. In some clearly identified circumstances, strong recommendations may be made based on lesser evidence when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms.	Practitioners should follow the recommendation. The rationale for an alternative is not present.
<b>Fair</b>	A <b>Fair</b> recommendation means that the workgroup believes that the benefits exceed the harms (or that the harms clearly exceed the benefits in the case of a negative recommendation), but the quality of evidence is not as strong (grade II or III)*. In some clearly identified circumstances, recommendations may be made based on lesser evidence when high-quality evidence is impossible to obtain and the anticipated benefits outweigh the harms.	Practitioners should follow the recommendation. The rationale for an alternative is not present. Information and preferences are considered.
<b>Weak</b>	A <b>Weak</b> recommendation means that the quality of evidence that exists is suspect or that well-done studies (grade I, II, or III)* show little clear advantage to one approach versus another.	Practitioners should follow the recommendation. The rationale for an alternative is not present. Whether to follow the recommendation is as <b>Weak</b> , and practitioners should be alert to emerging evidence. Patient preferences have a substantial influence.
<b>Consensus</b>	A <b>Consensus</b> recommendation means that Expert opinion (grade IV)* supports the guideline recommendation even though the available scientific evidence did not present consistent results, or controlled trials were lacking.	Practitioners should follow the recommendation. The rationale for an alternative is not present. <b>Consensus</b> , although based on alternatives, is a substantial influence.
<b>Insufficient Evidence</b>	An <b>Insufficient Evidence</b> recommendation means that there is both a lack of pertinent evidence (grade V)* and/or an unclear balance	Practitioners should follow the recommendation. The rationale for an alternative is not present. Deciding whether to follow the recommendation is labeled as <b>Insufficient Evidence</b> .

	between benefits and harms.	exercise judgment in evaluating the balance of benefits and harms. The balance of benefits and harms should be weighed against the preference shown by the patient and the influencing role of the patient's values and beliefs.
	<p>*Conclusion statements are assigned a grade based on the strength of the evidence. Grade I indicates that the evidence is strong and the balance of benefits and harms favors treatment; grade II indicates that the evidence is moderate and the balance of benefits and harms favors treatment; grade III, limited; grade IV signifies expert opinion only and grade V indicates that a grade cannot be assigned because there is no evidence to support or refute the conclusion. The evidence and these grades are used to assign a rating (Strong, Fair, Weak, Consensus, Insufficient Evidence - see chart above).</p> <p>Adapted by the American Dietetic Association from the American Academy of Pediatrics. 2004;114;874-877.</p>	

## GUIDELINE CONTENT COMPARISON

The American Association of Clinical Endocrinologists (AACE), the American Diabetes Association (Am Diabetes Assoc) and the American Dietetic Association (Am Dietetic Assoc) present recommendations for nutritional management of diabetes mellitus.

### Areas of Agreement

#### *MNT*

The guidelines agree that MNT is an essential component of any comprehensive diabetes mellitus management program and that it should be individualized for each patient. Am Diabetes Assoc and American Dietetic Assoc agree that MNT is best provided by a registered dietitian familiar with the components of diabetes MNT. AACE and American Dietetic Assoc state that factors to take into consideration while developing a diet include food intake/preferences, lifestyle (such as physical activity), medication regimen, metabolic control, glycemic control and anthropometric measurements. Am Diabetes Assoc notes that nutrition counseling should be sensitive to the individual's personal needs, willingness to change, and ability to make changes.

#### *Carbohydrate*

The groups agree that a dietary pattern that includes carbohydrate from fruits, vegetables, whole grains, legumes, and low-fat milk should be encouraged. There is also overall agreement that for individuals with T1DM, insulin therapy should be integrated into the dietary and physical activity pattern, and that the key to successful MNT is synchronizing carbohydrate intake with insulin therapy. Am Diabetes Assoc and Am Dietetic Assoc agree that carbohydrate intake should be kept consistent on a day-to-day basis with respect to time and amount. These two groups also agree that for individuals who are on insulin pump therapy, insulin doses should be adjusted based on the carbohydrate content of meals and snacks.

AACE notes that the use of basal-bolus insulin therapy using insulin analogs or continuous subcutaneous insulin infusion (insulin pump therapy) in conjunction with carbohydrate counting is the most physiologic treatment and provides the greatest flexibility in terms of food choices and timing of meals. They add that basal-bolus therapy using a consistent carbohydrate meal plan can be equally effective for patients unable or unwilling to count carbohydrates.

### *Protein*

The guideline groups agree that protein intake in individuals with diabetes mellitus and normal renal function should be the same as for patients who do not have diabetes mellitus, 15% to 20% of daily energy intake. Am Diabetes Assoc adds that protein should not be used to treat acute or prevent nighttime hypoglycemia in individuals with T2DM, and that high-protein diets are not recommended as a method for weight loss at this time.

### *Fiber*

Am Diabetes Assoc notes that, as for the general population, people with diabetes are encouraged to consume a variety of fiber-containing foods. They add, however, that evidence is lacking to recommend a higher fiber intake for people with diabetes than for the population as a whole. AACE specifies that individuals with diabetes should consume fiber in amounts of 25 to 50 g/day, or 15 to 25 g/1000 kcal ingested. Am Dietetic Assoc notes that recommendations for fiber intake for people with diabetes are similar to the recommendations for the general public (14 g/1000 kcal). While diets containing 44 to 50 grams of fiber daily are reported to improve glycemia, Am Dietetic Assoc continues, more usual fiber intakes (up to 24 grams daily) have not shown beneficial effects on glycemia. Am Dietetic Assoc also notes that including foods containing 25 to 30 grams of fiber per day, with special emphasis on soluble fiber sources (7 to 13 grams), can help to lower cholesterol. They add that diets high in total and soluble fiber, as part of cardioprotective nutrition therapy, can further reduce total cholesterol by 2% to 3% and LDL cholesterol up to 7%.

### *Sucrose*

The groups agree that sucrose does not need to be avoided by patients with diabetes mellitus. AACE and Am Dietetic Assoc agree that when consumed, however, sucrose should replace other carbohydrates. Am Diabetes Assoc notes that, in addition to being substituted for other carbohydrates, sucrose may also be added to the meal plan, but if so, should be covered with insulin or other glucose-lowering medications. Am Dietetic Assoc notes that sucrose intakes of 10 to 35 percent of total energy intake do not have a negative effect on glycemic or lipid responses when substituted for isocaloric amounts of starch.

### *Alcohol Consumption*

AACE and Am Diabetes Assoc agree that for adults with diabetes who choose to consume alcohol, consumption should be limited to 1 drink per day for women and 2 drinks per day for men. Am Diabetes Assoc also notes that to reduce risk of nocturnal hypoglycemia in individuals using insulin or insulin secretagogues, alcohol should be consumed with food. They add that moderate alcohol

consumption (when ingested alone) has no acute effect on glucose and insulin concentrations, but carbohydrate co-ingested with alcohol (as in a mixed drink) may raise blood glucose. Am Dietetic Assoc does not address alcohol consumption.

### *Dietary Fat and Cholesterol*

The guidelines agree that intake of trans fats should be minimized. AACE states that total dietary fat should generally comprise less than 30% of daily energy intake; the other two groups do not specify a percentage of recommended dietary fat intake. AACE and Am Diabetes Assoc are in agreement that n-3 polyunsaturated fatty acids have beneficial effects on the lipid profile, with AACE specifying that these should comprise most fat intake. Am Diabetes Assoc notes that two or more servings of fish per week (with the exception of commercially fried fish filets) provide n-3 polyunsaturated fatty acids and are recommended. Am Dietetic Assoc cites reduction in saturated and trans fats, as well as reduction of dietary cholesterol and interventions to improve blood pressure, as effective cardioprotective nutrition interventions for prevention and treatment of CVD.

### *Micronutrients*

Of the two guideline groups that address the use of micronutrients, AACE and Am Diabetes Assoc, neither group recommends they be used routinely. According to Am Diabetes Assoc, there is no clear evidence of benefit from vitamin or mineral supplementation in people with diabetes (compared with the general population) who do not have underlying deficiencies. AACE recommends their use only for patients with diabetes mellitus who have nonhealing wounds, recommending 1 daily multivitamin and adequate protein for optimal nitrogen retention. They add that additional micronutrients, such as zinc and oral vitamins C and A, can be considered depending on the severity of the wounds and the nutritional status of the patient.

### *Nutritional Interventions for Preventing and Managing Diabetes Complications*

All three groups agree that protein intake should be restricted in individuals with diabetes and CKD. Recommendations are similar with AACE recommending 0.8 g/d (stages 1 to 2), 0.6 g/d (stages 3 to 4), 1.2 g/d (stage 5 on hemodialysis), and 1.3 g/d (stage 5 on peritoneal dialysis). Am Diabetes Assoc recommends 0.8 to 1.0 g/kg body weight/day in the earlier stages of CKD and to 0.8 g/kg body weight/day in the later stages of CKD. Am Dietetic Assoc recommends a protein intake of 1 g or less/kg body weight/day during the first two stages. They add that for persons with late stage diabetic nephropathy (CKD Stages 3-5), a protein intake of approximately 0.7 grams per kg body weight per day has been associated with hypoalbuminemia, whereas a protein intake of approximately 0.9 grams per kg body weight per day has not.

AACE also provides recommendations for the restriction of sodium, phosphate, potassium for individuals with diabetes and CKD.

Am Diabetes Assoc and Am Dietetic Assoc provide specific nutrition interventions for the prevention and treatment of CVD. Am Dietetic Assoc recommends that cardioprotective interventions be implemented in the initial series of encounters,

and should include reduction in saturated and trans fats and dietary cholesterol, as well as interventions to improve blood pressure. Am Diabetes Assoc states that for patients with diabetes at risk for cardiovascular disease, diets high in fruits, vegetables, whole grains, and nuts may reduce the risk.

### *Physical Activity and Weight Management*

AACE and Am Dietetic Assoc recommend physical activity (30 to 90 mins/day [AACE]; 90 to 150 mins/week [Am Dietetic Assoc]) for individuals with T2DM to improve glycemic control. Am Dietetic Assoc also recommends resistance/strength training three times per week. According to Am Dietetic Assoc, although exercise is not reported to improve glycemic control in persons with T1DM, these individuals should be encouraged to engage in regular physical activity to receive the same benefits from exercise as the general public (e.g., decreased risk for cardiovascular disease and improved sense of well-being).

The guidelines also address the role of weight loss in glycemic management. Am Diabetes Assoc recommends weight loss for overweight and obese insulin-resistant individuals. They add that that weight loss medications and bariatric surgery may be considered for certain patients with type 2 diabetes. According to the Am Dietetic Assoc, while decreasing energy intake may improve glycemic control, it is unclear whether weight loss alone will improve glycemic control.

### **Areas of Differences**

#### *Dietary Fat and Cholesterol*

Recommendations regarding intake of saturated fat and cholesterol differ slightly. Am Diabetes Assoc recommends that saturated fat be limited to <7% of total daily calories, and cholesterol limited to <200g per day. AACE, however, recommends these same intakes only in patients with an LDL-C level greater than 100 mg/dL. Otherwise, they recommend saturated fat be limited to <10% of daily energy intake and cholesterol limited to <300 mg/day.

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